

SOLID-CHEMICAL COMPOSITIONS, GEOCHEMICAL BINDER SYSTEM, AND IMPROVED HIGH-SHEAR GRANULATION PROCESS FOR BOTH CONVENTIONAL AND SLOW-RELEASE FERTILIZER AND BIOREMEDIATION NUTRIENT COMPOSITIONS

ABSTRACT

This invention discloses advanced means for the formulation and preparation of solid-chemical compositions which provide sources of water-soluble nutrients, electron acceptors and other agents for agriculture and waste-treatment, in particular, the bioremediation of contaminated environmental media. The disclosed formulations and means of production of the slow-release solid-chemical compositions of the present invention utilize a novel and economical "biphasic" chemical-system technology which involves a combination of a first "nutrient" component (1) which comprises water-soluble nutrients and other biologically utilizable substances with a second component (2) which comprises an inorganic geochemical-binder system. The simplest embodiment of the geochemical-binder system comprises one or more salts of phosphoric acid. In the preferred embodiments of the present invention intended for the slow-release of the ingredients contained in the "nutrient" component (1), the geochemical-binder system of component (2) comprises a combination of one or more salts of phosphoric acid with a inorganic binder matrix preferably containing a mixture of low-solubility carbonates, carbonate minerals, phosphates and phosphate minerals. The different embodiments of the geochemical-binder system of this invention allows a wide variation of formulations of the nutrient component (1) to be prepared in both conventional and slow-release forms using an improved high-shear granulation process whereby the dangerous chemicals typically used in the granulation process are largely or completely replaced with water. The present invention discloses means by which such compositions can be economically prepared in large quantities so as to meet the specific needs of different sectors of the agricultural/agribusiness and phytoremediation/bioremediation markets.

The disclosed solid-chemical compositions of the present invention provide improved, cost-effective means for slowing and controlling the release-rate profiles of water-soluble nutrients, such as nitrogen- and phosphorus-rich compounds, and improved means for enhanced and/or time-targeted nutrient uptake by plants and microorganisms. The present invention also provides improved means for the reduction of nutrient run-off from agricultural areas into surface waters and means of preventing or minimizing nutrient-contamination of ground-water aquifers.